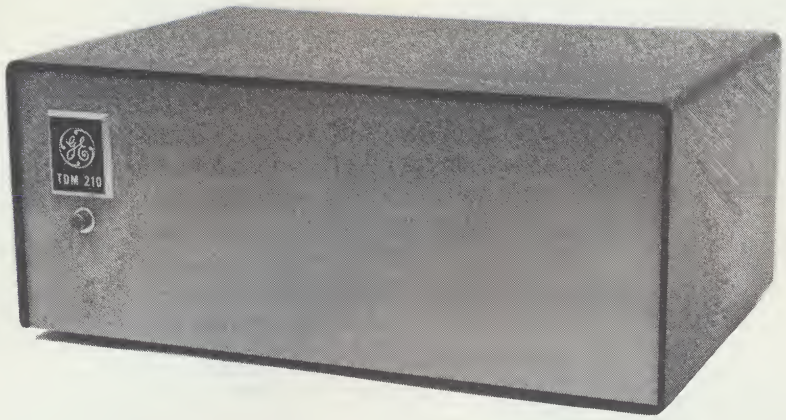
TELECOMMUNICATIONS
COMMUNICATION PRODUCTS DEPARTMENT
LYNCHBURG, VIRGINIA

PRODUCT NEWS



TDM 210

DATA SET-FSK

1800 BITS/SEC

The TDM-210 Data Set provides an asynchronous binary, serial data transmission facility for private line service. Data pulses are converted into FM signals suitable for transmission over 3 KC voice channels. At the receiving end the FM signals are restored to their original binary form for delivery to the business machine.

- COMPACT-ECONOMICAL-ATTRACTIVE
  Low cost, long life
- WIDE TEMPERATURE OPERATION
  -20° C to +60° C
- SIMPLIFIED MAINTENANCE
  Adjust and test in place
  Plug-in circuit modules
- BUILT-IN EQUALIZERS
  Slope and phase correction
  for non-conditioned circuits
- COMPATIBLE WITH BELL 202D
  End-to-end operation
- ALL SILICON TRANSISTORS
  For added reliability
- LOOP-BACK SWITCH
  Isolates trouble quickly
  Data Set and line loop-back
- EIA STD. RS-232B INTERFACE
  Plug-in compatibility
  with terminal devices

- PRICE $675.00

Description

The TDM-210 Data Set is designed to connect data terminal equipment to either 2-wire or 4-wire private line circuits. The TDM-210 permits asynchronous transmission of binary data at speeds up to 1,800 bits per second. The transmitter, receiver, and power supply are packaged as separate plug-in modules with test points and adjustments easily accessible through the hinged rear cover. The pilot lamp indicates that the D.C. voltages are present and that the loop-back switch is in the "operate" position.

TECHNICAL SUMMARY

COMPATIBILITY
Over the line with Bell 202D

MODULATION TECHNIQUE - FSK

FREQUENCIES - Mark - 1200HZ
Space - 2200HZ

DATA RATES, FCC TARIFF 237 -
1000 Bits/Sec. Schedule 4
1400 Bits/Sec. Schedule 4A
1800 Bits/Sec. Schedule 4B

LOOPBACK SWITCH - Connects transmitter output to receiver input; connects receive line to send line.

PILOT LAMP - Indicates that D.C. power is present and that loopback switch is in the "operate" position.

POWER REQUIREMENTS -
117 v ±10% 50-60 HZ, 10 Watts

OPERATING ENVIRONMENT -
Temperature -20°C to +60°C
Relative Humidity 0 to 95%
Altitude 0 to 10,000 Ft.

SIZE - 9" x 13 3/4" x 6" High

WEIGHT - 13 Pounds

MOUNTING - Rubber Feet

CONNECTIONS -
Line; 4 Wire Telephone cord, 12 ft.
Digital; 25 pin Cannon or Cinch DB25S connector
Power; 3 Wire Cord included, 10 ft.

LINE 2 wire or 4 wire
Xmit level - +6 dbm to -30 dbm
Rec level - -30 dbm threshcld
Impedance - 600 or 900 ohms

DIGITAL INTERFACE -
Complies with EIA-RS232B

DIGITAL SIGNALS PROVIDED -

AA	1	Protective Ground
AB	7	Signal Ground
BA	2	Transmitted Data
CA	4	Request to Send
CB	5	Clear to Send
BB	3	Received Data
CF	8	Data Carrier Detector
CC	6	Data Set Ready
	9	+12 VDC (test purpose only)
	10	-12 VDC (test purpose only)

CARRIER DETECTOR -
Operate Time 40 Msec.
Release Time 15 Msec.

JUMPER SELECTABLE FUNCTIONS

CLEAR TO SEND - Delay, 10, 60, 120, 200 Msec.

CLAMP - Holds "received data" in mark condition when carrier is absent.

SQUELCH - Holds "received data" circuit in mark condition for 150 ms after "request to send" is dropped.

PHASE EQUALIZER - (Referred to 1900HZ)
900 µs at 600, 3000HZ
250 µs at 1200, 2300HZ

SLOPE EQUALIZER - 5 db/octave

For additional information contact:

DALLAS	B. Giddings	214-526-0265	ATLANTA	A. Sinclair	404-233-5373
KANSAS CITY	R. Manahan	913-649-7131	PHILA.	M. Burt	215-927-4939
SAN FRANCISCO	F. Harper	415-368-4681	WASH DC	R. Lowery	202-393-3600
HEADQUARTERS	LYNCHBURG, VA.	J. Adams	703-846-7311 EXT. 431		

Prices are FOB Lynchburg, Va., Terms NET 30 Days

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE

GENERAL ELECTRIC COMPANY

MOUNTAIN VIEW ROAD, LYNCHBURG, VIRGINIA 24502 . . . Cable GECOMPROD . . . Tel. 846-7311

COMMUNICATION PRODUCTS DEPARTMENT

ANNOUNCING GENERAL ELECTRIC'S NEW TDM-210
AN 1800 BPS DIGITAL DATASET

Dear Sir:

The high cost of data communications concerns the whole computer industry. General Electric's new TDM-210 Digital Dataset offers a way to cut those costs.

Designed for leased line (FCC Tariff 260 Schedule 4) or other equivalent private communication line service, the TDM-210 is built to industry standards with an RS-232B interface and end-to-end compatibility with Bell's 202D1.

Easy installation, solid-state long life design, and simplified test procedures are other attractive features of the new low cost dataset.

For prices and delivery, call your nearest General Electric Communications office, or the writer.

Very truly yours,

J. C. Adams

J. C. Adams
Manager
Data Communication Sales

encl:

GENERAL ELECTRIC

COMMUNICATION PRODUCTS DEPARTMENT
MOUNTAIN VIEW ROAD • LYNCHBURG, VIRGINIA



G. H. FLOYD
BOX 4197
LYNCHBURG, VIRGINIA 24502

communications

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We sincerely hope that you will find it interesting and helpful. If you desire further information, such as prices, etc., detach the enclosed card and drop in the mail. Our local Representative will contact you.

Yes, I would like a General Electric District Sales Manager to contact me with regard to your latest telecommunication equipment.

Name _____

Title _____

Firm _____

Address _____

City _____

Phone No. _____

ECM

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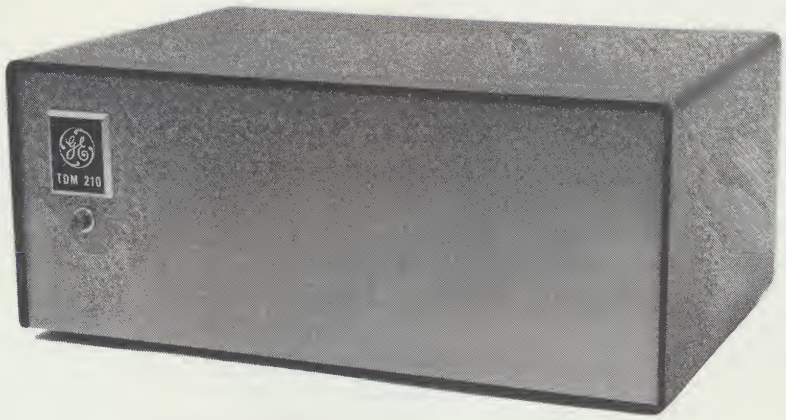
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COMMUNICATION PRODUCTS DEPARTMENT
LYNCHBURG, VIRGINIA

PRODUCT NEWS



TDM 210

DATA SET-FSK

1800 BITS/SEC

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  -20° C to +60° C
- SIMPLIFIED MAINTENANCE
  Adjust and test in place
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- BUILT-IN EQUALIZERS
  Slope and phase correction
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- COMPATIBLE WITH BELL 202D
  End-to-end operation
- ALL SILICON TRANSISTORS
  For added reliability
- LOOP-BACK SWITCH
  Isolates trouble quickly
  Data Set and line loop-back
- EIA STD. RS-232B INTERFACE
  Plug-in compatibility
  with terminal devices

- PRICE $675.00

ECM-248

Description

The TDM-210 Data Set is designed to connect data terminal equipment to either 2-wire or 4-wire private line circuits. The TDM-210 permits asynchronous transmission of binary data at speeds up to 1,800 bits per second. The transmitter, receiver, and power supply are packaged as separate plug-in modules with test points and adjustments easily accessible through the hinged rear cover. The pilot lamp indicates that the D.C. voltages are present and that the loop-back switch is in the "operate" position.

TECHNICAL SUMMARY

COMPATIBILITY
Over the line with Bell 202D

MODULATION TECHNIQUE - FSK

FREQUENCIES - Mark - 1200HZ
Space - 2200HZ

DATA RATES, FCC TARIFF 237 -
1000 Bits/Sec. Schedule 4
1400 Bits/Sec. Schedule 4A
1800 Bits/Sec. Schedule 4B

LOOPBACK SWITCH - Connects transmitter output to receiver input; connects receive line to send line.

PILOT LAMP - Indicates that D.C. power is present and that loopback switch is in the "operate" position.

POWER REQUIREMENTS -
117 v ±10% 50-60 HZ, 10 Watts

OPERATING ENVIRONMENT -
Temperature -20°C to +60°C
Relative Humidity 0 to 95%
Altitude 0 to 10,000 Ft.

SIZE - 9" x 13 3/4" x 6" High

WEIGHT - 13 Pounds

MOUNTING - Rubber Feet

CONNECTIONS -
Line; 4 Wire Telephone cord, 12 ft.
Digital; 25 pin Cannon or Cinch DB25S connector
Power; 3 Wire Cord included, 10 ft.

LINE 2 wire or 4 wire
Xmit level - +6 dbm to -30 dbm
Rec level - -30 dbm threshcld
Impedance - 600 or 900 ohms

DIGITAL INTERFACE -
Complies with EIA-RS232B

DIGITAL SIGNALS PROVIDED -

AA	1	Protective Ground
AB	7	Signal Ground
BA	2	Transmitted Data
CA	4	Request to Send
CB	5	Clear to Send
BB	3	Received Data
CF	8	Data Carrier Detector
CC	6	Data Set Ready
	9	+12 VDC (test purpose only)
	10	-12 VDC (test purpose only)

CARRIER DETECTOR -
Operate Time 40 Msec.
Release Time 15 Msec.

JUMPER SELECTABLE FUNCTIONS

CLEAR TO SEND - Delay, 10, 60, 120, 200 Msec.

CLAMP - Holds "received data" in mark condition when carrier is absent.

SQUELCH - Holds "received data" circuit in mark condition for 150 ms after "request to send" is dropped.

PHASE EQUALIZER - (Referred to 1900HZ)
900 µs at 600, 3000HZ
250 µs at 1200, 2300HZ

SLOPE EQUALIZER - 5 db/octave

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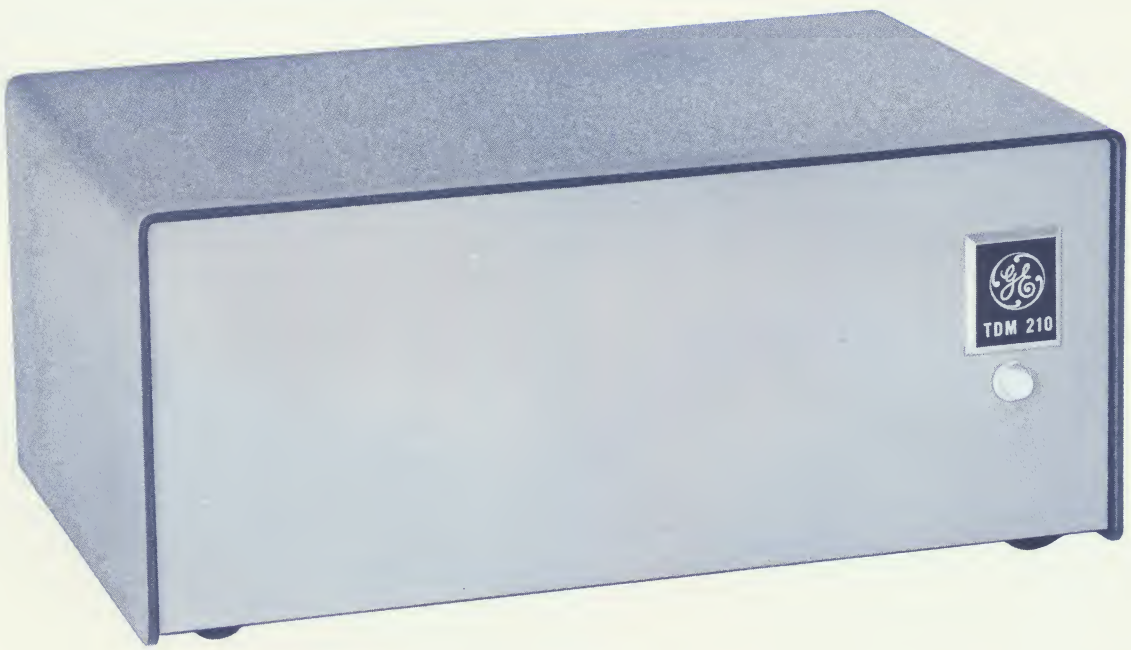
Phone No. _____

ECM

TELECOMMUNICATIONS

The General Electric TDM-210 Data Set-FSK

A solid-state frequency shift keyed Data Set for accurate transmission of serial binary data at speeds up to 1800 bits per second over standard 2 or 4 wire private line voice circuits.



GENERAL ELECTRIC

GENERAL

The General Electric TDM-210 Data Set, Figure 1, provides an economical and reliable means for interconnecting data handling equipment to a private telephone line facility. The TDM-210 Data Set accurately translates serial business machine information into FM signals bi-directionally, for ready transmission to and from the telephone line or private microwave circuits. The TDM-210 operates half or full duplex over 2 or 4-wire lines, respectively. Because of its asynchronous mode of operation no elaborate end-to-end synchronization is required, and transmission can begin and cease at will. The TDM-210 transmits and/or receives information at up to 1800 bits per second over a standard 3 kc voice type circuit. End-to-end communication is with another TDM-210 or Bell 202-D or its equivalent.

The TDM-210 is completely modular and of solid-state design to facilitate easy alignment and test, and provide maximum state-of-the-art reliability. Silicon transistors are used throughout. Because of its light weight, small size, low power requirements and only two cable connections—installation requirements are absolutely minimal. Power consumption is only 5 watts total. The TDM-210 is available in a smartly designed cabinet for desk top mounting or for rack mounting along with related equipment.

Because the TDM-210 Data Set matches EIA specification RS-232B it can transmit business machine or peripheral device information, meeting these same EIA specifications at up to the 1800 bits per second as mentioned above.

To minimize operator induced errors, only one control is located on the TDM-210. This control is a two position switch located on the rear panel (Figure 2); Position One is the normal or operate position and Position Two the test or "loop back" position. Mounted on the front panel, is an indicator which lights while DC is present internally, and, the test switch is in the operate position. If either of these two conditions is changed the control lamp extinguishes.



FIG. 1

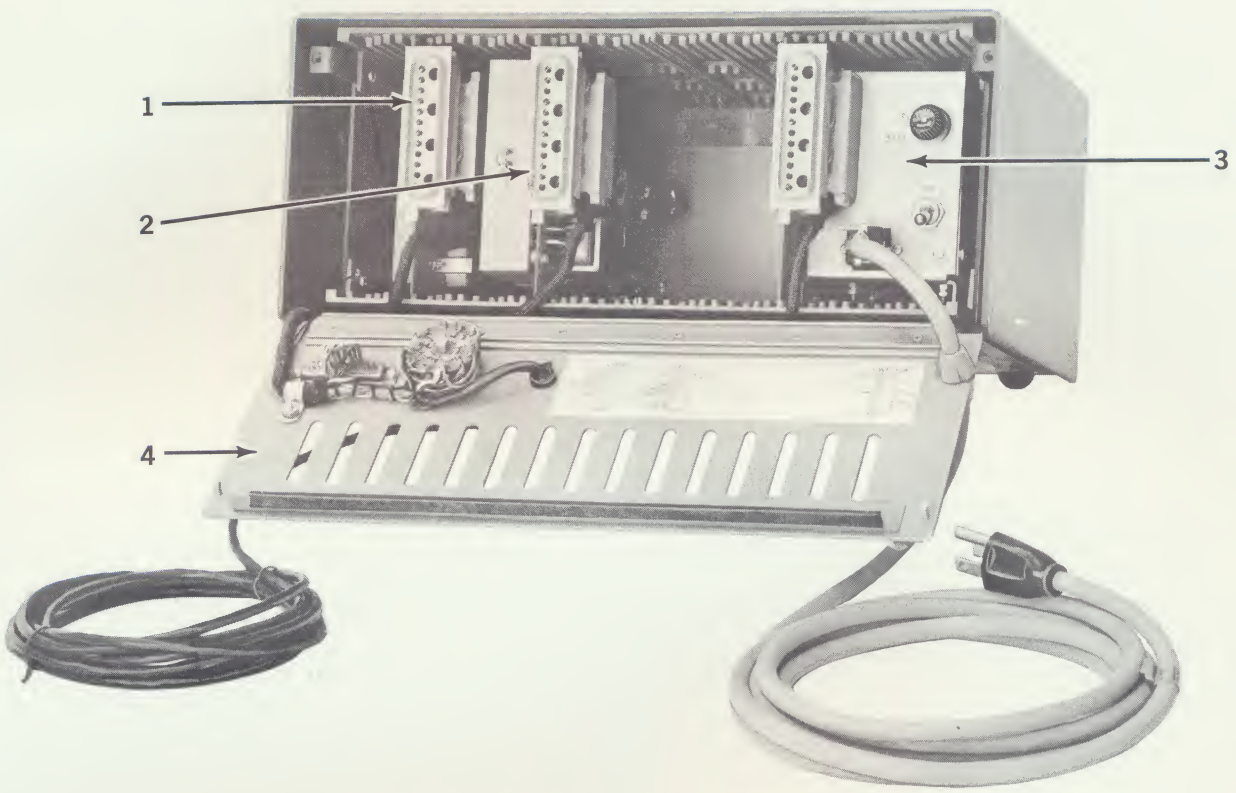
The TDM-210 is designed to condition and exchange data between the data equipment and telephone line at a maximum rate of 1800 bits per second. This maximum rate of transfer is accomplished over a voice circuit whose specifications are equivalent to those defined under FCC Tariff 260 for Schedule 4, Type 4B. The Data Set is also designed to match the lower line rate capabilities of Schedule 4, Type 4 and 4A lines. The data exchange rate for these latter type circuits are 1000 and 1400 bits per second, respectively.

The appropriate information signals enter the TDM-210 from the data terminal or telephone line-bit serially. Following signal conditioning, FM signals are presented to the telephone line or digital signals to the data terminal. Since each bit is handled serially, the particular machine code or number of levels of the code are of no particular significance.



1. Telephone Cord Connector
2. Standard RS-232 Cinch Socket (For Connecting to Data Terminal)
3. Test/Operate Switch (Shown in Operate Position)
4. Cooling Vents
5. Power Cord with Grounding Pin

FIG. 2—REAR VIEW



1. Transmitter Module
2. Receiver Module
3. Power Supply Module
4. Hinged Panel

FIG. 3—REAR VIEW (Hinged Panel Open)

All system alignment controls and circuit test points are located on the end of the printed circuit modules and are available immediately behind the hinged panel (Figure 3). It is, therefore, unnecessary to remove or place the modules on extenders for system alignment and test. A label on the inside of the hinged panel identifies each module's position in the cabinet and all test points on each module. Access to the modules for test and alignment is achieved by lowering the rear hinged panel.

The circuit test points and the modules they are associated with are listed below:

Transmitter	Receiver	Power Supply
+12 VDC	+12 VDC	+12 VDC
−12 VDC	−12 VDC	−12 VDC
+6.5 VDC	Carrier Input	Common Signal Ground
Transmitted Data	Carrier-Input to Preamp	
Request to Send	Data-Low Pass Filter Out	
Receiver Squelch	Received Data	
Clear to Send	Carrier Detector	
Carrier-Input to Filter	Signal Ground	
Carrier Output		
Signal Ground		

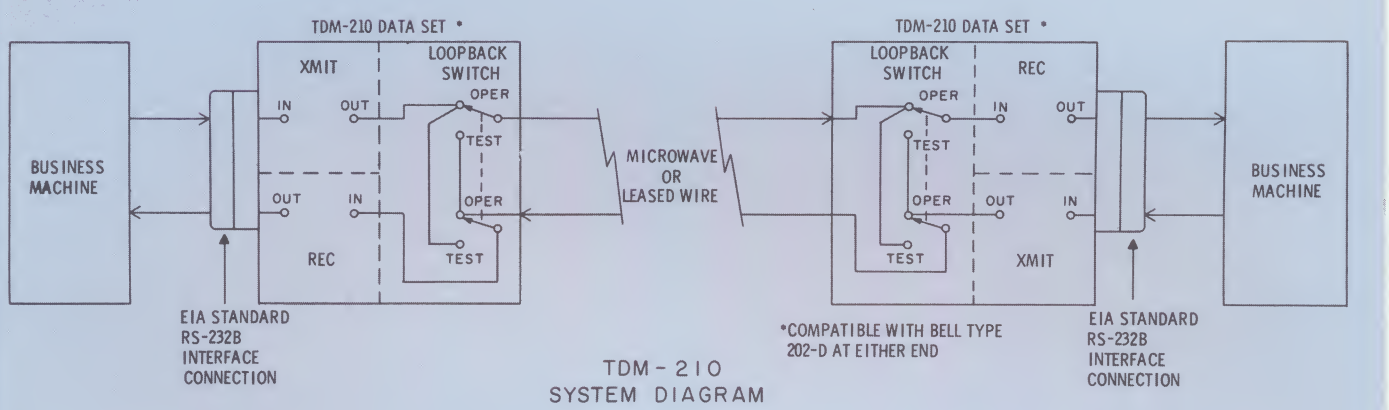
TEST/OPERATE SWITCH

The test/operate switch, located on the hinged panel, provides a means for analyzing 4-wire circuit operation. The switch connection in the circuit is diagrammed in Figure 4.

With the switch in the operate position, the transmit and receive modules of the Data Set are coupled to the telephone line for normal operation. With the switch in the test position, the output of the transmit module is coupled to the input of the receive module and the telephone line is looped. The test position provides a means for locating fault conditions encountered during transmission.

With the distant Data Set test switch in the test position, data can be transmitted from the local data terminal onto the line and looped back. This provides a means of testing the local and line transmission paths without the distant equipment in the circuit.

For 2-wire circuits, half-duplex operation only is allowed; therefore, the above test is not performed.

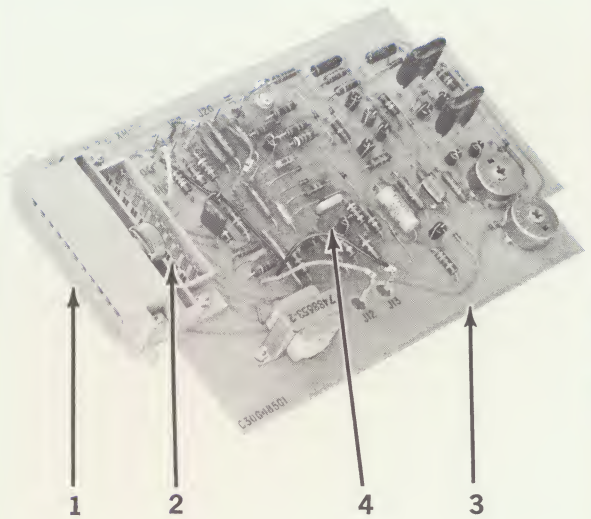


TDM-210
SYSTEM DIAGRAM

FIG. 4

TRANSMITTER OPERATION

Figure 5A pictures the transmitter module board and Figure 5B is a block schematic of the transmitter for the following operational description. The transmitter consists of a voltage controlled multivibrator which converts the binary input data into a frequency modulated signal suitable for transmission over the voice circuit. The transmitter responds to two input signals from the data terminal equipment: "Request To Send" and "Transmitted Data". The Request To Send signal turns the carrier "on" and "off" and the Transmitted Data signal shifts the multivibrator between the MARK/SPACE (NO BIT/BIT) frequencies. An Off signal on the Request To Send input turns carrier off and gives an Off signal on the Clear-To-Send lead. An On signal on the Request To Send input turns carrier on and causes the Clear-To-Send circuit to give an On signal after a fixed delay. Delays of 10, 60, 120 and 200 milliseconds may be customer selected by jumper option. An Off signal on the Request To Send lead also produces a 150 millisecond pulse at the transmitter receiver squelch output. This option is used in 2-wire operation to clamp the receiver in a marking condition for 150 milliseconds. This option



1. Signal Test Points
2. Module Connector Block
3. Epoxy Printed Circuit Board
4. Option Jumper Wiring

FIG. 5A—TRANSMITTER MODULE

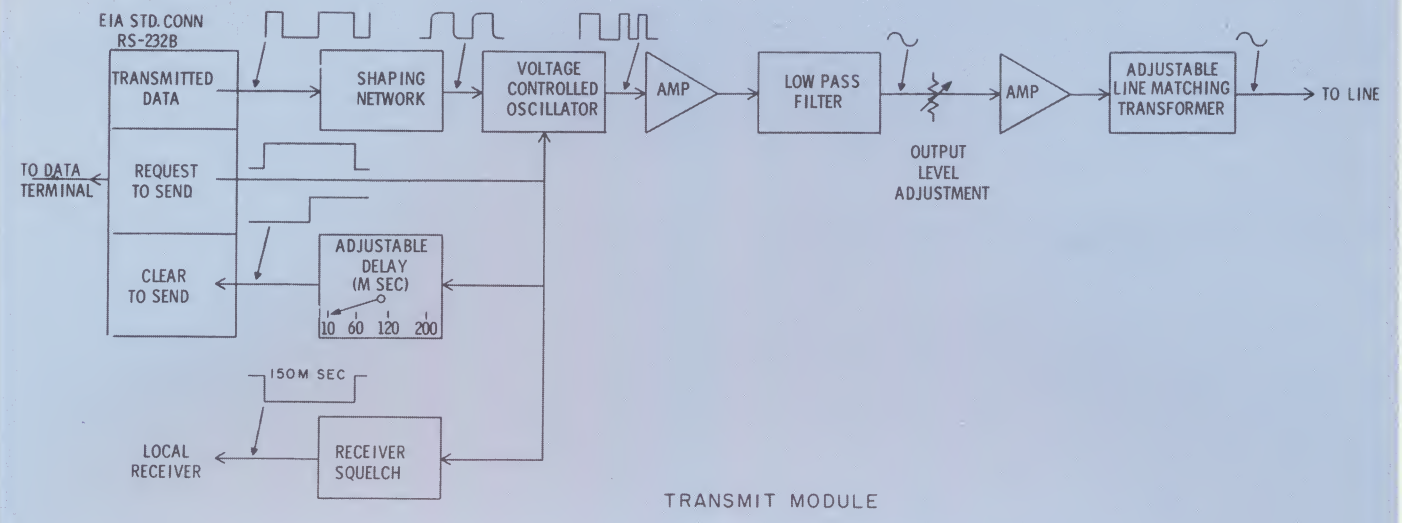


FIG. 5B

may be strapped out in 4-wire operation.

The MARK (No Bit) and SPACE (Bit) frequencies generated by the voltage controlled multivibrator are 1200 ±12 cps and 2200 ±22 cps respectively. Carrier is cut off only at the end of a carrier pulse. This prevents transients which might give false received data output in the received signal. Transmitted data is passed through a shaping network which reduces mark-to-space and space-to-mark rise times. This reduces unwanted frequency components in the carrier band.

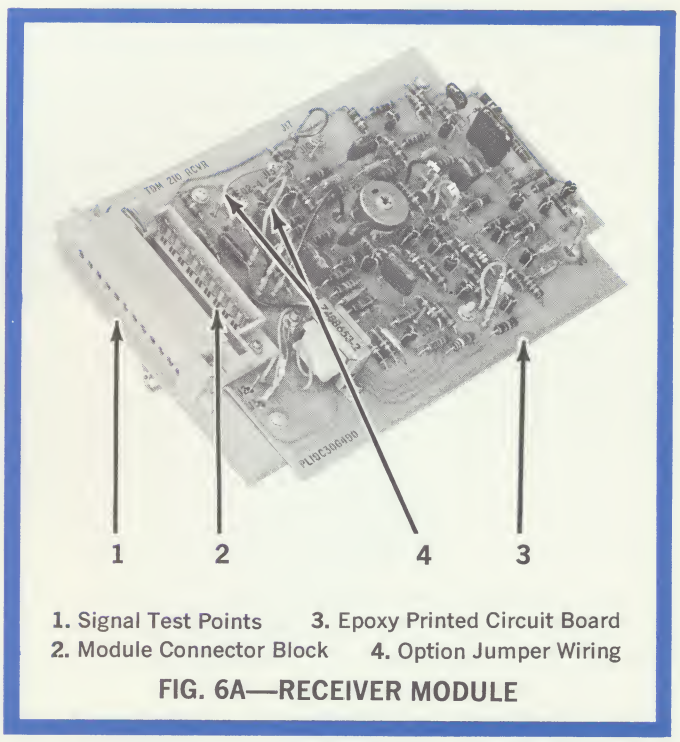
The output from the multivibrator is amplified and passed through a low-pass filter, resulting in a nearly sinusoidal carrier signal. Output of the low-pass filter is amplified and coupled to the line by a transformer. Output impedance of the transmitter is selected by jumper option and may be 600 ohms ±10%, and 900 ohms ±10% or greater than 6,000 ohms (for 2-wire operation). Carrier output level can be adjusted from −30 dbm to +6 dbm. This adjustment is located on the end of the transmitter module and adjustment can be made with the module in its normal operating position in the cabinet.

The maximum power requirement of the transmitter is 65 milliamps @ +12 VDC and 15 milliamps @ −12 VDC.

RECEIVER OPERATION

Figure 6A pictures the receiver module board and Figure 6B is a block schematic of the receiver for the following operational description. The receiver is coupled to the voice circuit by a transformer. The received signal is passed through a bandpass filter and through a compromise delay equalizer if needed. The input impedance of the receiver is 600 ohms ±10% or 900 ohms ±10% and is customer selected by jumper option. The delay equalizer may be strapped in or out. After the carrier signal has passed through the filter and equalizer, it is amplified by the pre-amplifier. The gain of the pre-amplifier is adjusted by a sensitivity control located at the input of the pre-amplifier. Amplitude equalization is also obtained in the pre-amplifier if required. This option may be strapped in or out. The slope of the amplitude equalizer is approximately 5 db per octave. The pre-amplifier provides an input signal for the limiter amplifier and level detector circuits.

In the limiter amplifier circuit the signal is squared, rectified and differentiated. This provides a sequence of negative pulses which mark the zero crossings of



1. Signal Test Points
2. Module Connector Block
3. Epoxy Printed Circuit Board
4. Option Jumper Wiring

FIG. 6A—RECEIVER MODULE

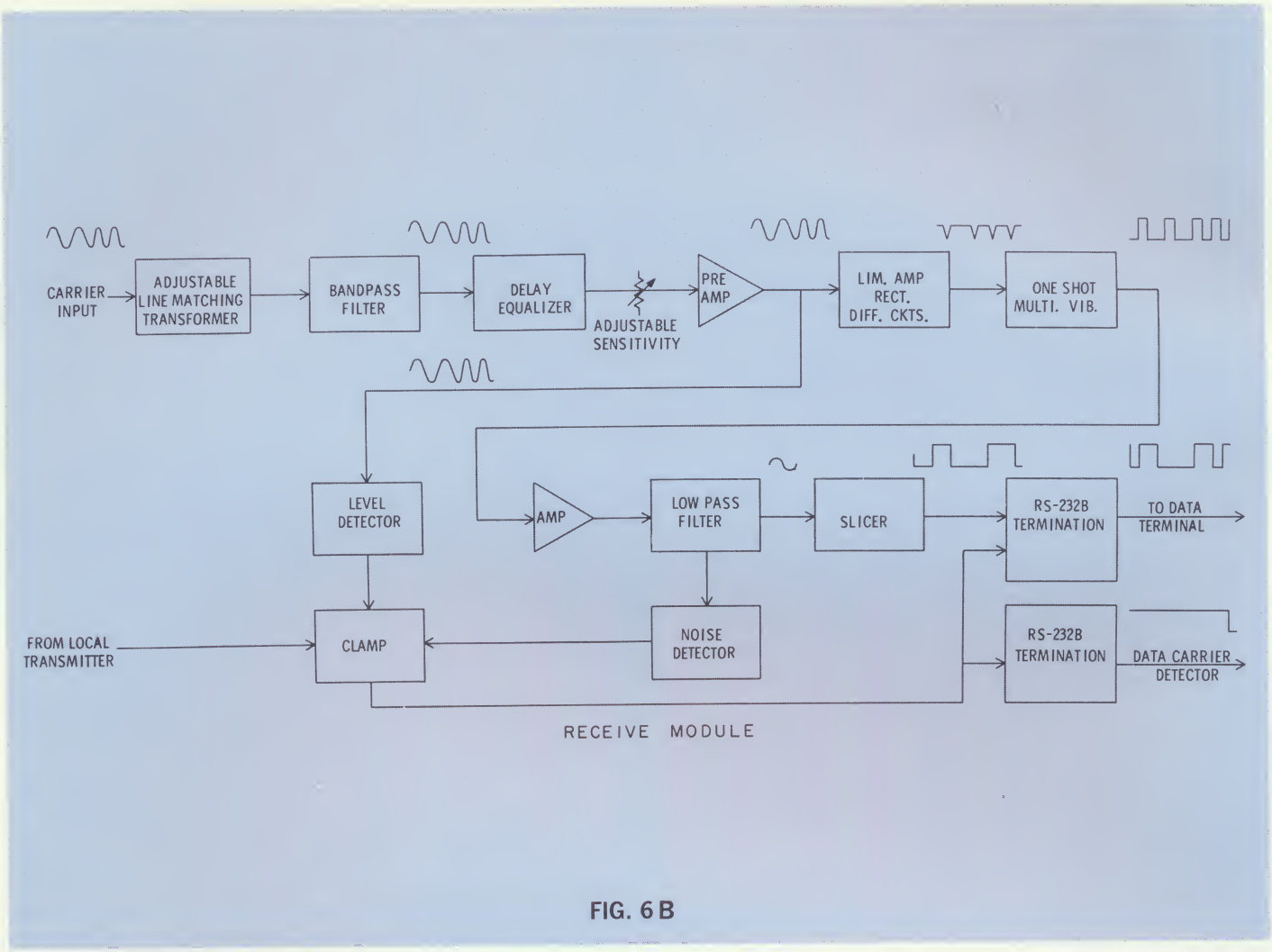


FIG. 6 B

the received signal. These pulses are used to trigger a one-shot multivibrator which gives an accurately timed pulse for each trigger pulse.

Pulses from the multivibrator are amplified and applied to the input of a low-pass filter. The low-pass filter integrates the pulses from the multivibrator, producing a more positive voltage for the higher frequency signal. This analog data wave from the output of the filter switches a differential amplifier. This amplifier has threshold level control to adjust for zero bias distortion. The resulting data signals are then converted to RS-232B data interface voltage signals by the output amplifier.

The level detector circuit clamps the output amplifier in a marking condition until the input signal reaches sufficient level for limiting. A noise detector circuit connected to the output of the low-pass filter also clamps the output amplifier in a marking condition when there is no signal input. When a signal is applied to the receiver the clamp is removed after 40 milliseconds. The clamp has a hold-over time of 15 milliseconds so that short dropouts of carrier will not clamp the receiver in a MARK condition. The clamp circuit may be strapped out when necessary. The level and noise detector output signals are converted to RS-232B data interface voltage signals by the carrier detector output amplifier.

Limiting circuitry is set to allow for a signal fade margin of 10 db. The sensitivity control is located at the end of the receiver module and the adjustment is made with the module in its normal operating position.

The maximum power requirement of the receiver is 30 milliamps @ +12 VDC and 10 milliamps @ −12 VDC.

RACK MOUNTING

Where a need exists for multiple Data Sets at a single location, provision is made for rack mounting. When rack mounted, up to 5 Data Sets can be accommodated by a single power supply. Under this arrangement the 5 Data Sets and power supply would occupy two standard 19″ rack shelves, 7 and 5¼ inches respectively, or a total of 7 rack units high. Three Data Sets would occupy one shelf and the two remaining Data Sets and the power supply would occupy the second shelf. Multiple shelf arrangements are available by stacking.

CONNECTION TO VOICE CIRCUIT

Transformer coupling to the telephone line provides metallic isolation between the Data Set and the actual telephone line itself. A 12 ft., four conductor, telephone type cord is supplied for connecting the Data Set to the telephone line facility.

COOLING

Because of low heat generation, natural air flow is sufficient to prevent heat buildup within the TDM-210 Data Set. Cooling air enters the unit along the bottom sides, flows over the modules and exits through air vents in the hinged panel in the rear.

RELIABILITY

Highest quality component parts are used throughout the TDM-210, and are of standard make and available from multiple sources.

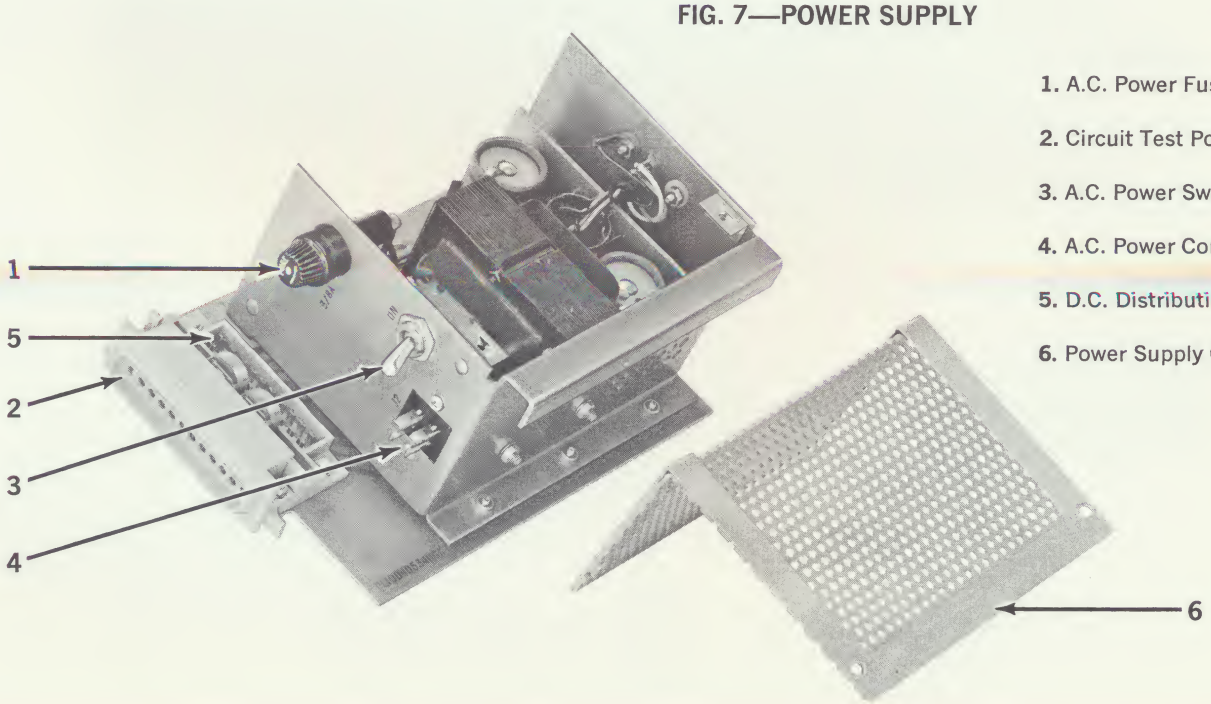
MTBF (Mean Time Between Failure) reliability figures, in thousands of hours, have been established for each module as well as the complete Data Set. These figures were established with the RADC Reliability Notebook as reference and are available upon request.

POWER SUPPLY

The power supply module is shown in Figure 7. The DC output is "short proof". If the load on the supply becomes shorted the supply is deactivated and the indicator lamp extinguishes, noting this condition. The power supply module plugs into either the desk or rack mounted cabinet. A 10-foot power cord with ground conductor and pin is supplied.

Shielding and protection from accidental contact with 115 AC is provided by a dust cover over the power supply. AC power is fused at ⅜ amps using standard AGC type fuses. To prevent accidental turn-off of AC power, the AC power switch is located on the power supply module inside the Data Set.

FIG. 7—POWER SUPPLY



1. A.C. Power Fuse
2. Circuit Test Points
3. A.C. Power Switch
4. A.C. Power Connector
5. D.C. Distribution Connector
6. Power Supply Cover

TECHNICAL SUMMARY

COMPATIBILITY
On line with Bell 202D

MODULATION TECHNIQUE—Frequency Shift Keyed (FSK)

FREQUENCIES—Mark—1200 cps
Space—2200 cps

DATA RATES, FCC TARIFF 260—
1000 Bits/Sec. Schedule 4
1400 Bits/Sec. Schedule 4A
1800 Bits/Sec. Schedule 4B

LOOPBACK SWITCH—Connects transmitter output to receiver input; connects receive line to send line.

PILOT LAMP—Indicates that D.C. power is present and that loopback switch is in the "operate" position.

A.C. REQUIREMENTS—
117 v ±10% 50-60 cps

POWER CONSUMPTION—5 watts.

OPERATING ENVIRONMENT—
Temperature −20°C to +60°C
Relative Humidity 0 to 95%
Altitude 0 to 10,000 ft.

SIZE—9" x 13¾" x 6" High

WEIGHT—14.5 Pounds

MOUNTING—Rubber Feet

CONNECTIONS—
Line; 4 Wire Telephone cord, 12 ft.
Digital; 25 pin Cannon or Cinch DB25S connector
Power; 3 Wire Cord included, 10 ft.

LINE 2 wire or 4 wire
Xmit level —+6 dbm to −30 dbm
Rec level —−30 dbm threshold
Impedance—600 or 900 ohms

DIGITAL INTERFACE—
Complies with EIA-RS232B

DIGITAL SIGNALS PROVIDED—

AA	1	Protective Ground
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BA	2	Transmitted Data
CA	4	Request to Send
CB	5	Clear to Send
BB	3	Received Data
CF	8	Data Carrier Detector
CC	6	Data Set Ready
	9	+12 VDC (test purpose only)
	10	−12 VDC (test purpose only)

CARRIER DETECTOR—
Operate Time 40 Msec.
Release Time 15 Msec.

JUMPER SELECTABLE FUNCTIONS

CLEAR TO SEND—Delay, 10, 60, 120, 200 Msec.

CLAMP—Holds "received data" in mark condition when carrier is absent.

SQUELCH—Holds "received data" circuit in mark condition for 150 ms after "request to send" is dropped.

PHASE EQUALIZER—(Referred to 1900 cps)
900 μs at 600, 3000 cps
250 μs at 1200, 2300 cps

SLOPE EQUALIZER—5 db/octave

FOR ADDITIONAL INFORMATION CONTACT:

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KANSAS CITY	913-649-7131	PHILA.	215-927-4939
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GENERAL ELECTRIC

COMMUNICATION PRODUCTS DEPARTMENT LYNCHBURG, VIRGINIA

(In Canada, Canadian General Electric Company, Ltd., 830 Lansdowne Rd., Toronto, Ontario)

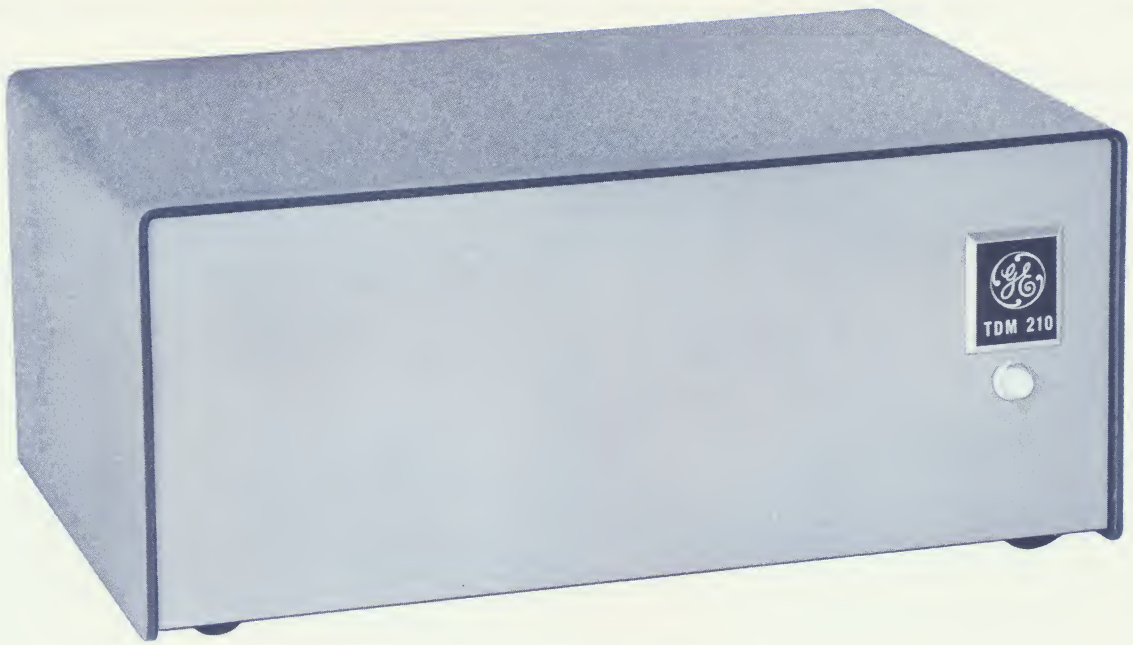
ECM-249

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TELECOMMUNICATIONS

The General Electric TDM-210 Data Set-FSK

A solid-state frequency shift keyed Data Set for accurate transmission of serial binary data at speeds up to 1800 bits per second over standard 2 or 4 wire private line voice circuits.



GENERAL ELECTRIC

GENERAL

The General Electric TDM-210 Data Set, Figure 1, provides an economical and reliable means for interconnecting data handling equipment to a private telephone line facility. The TDM-210 Data Set accurately translates serial business machine information into FM signals bi-directionally, for ready transmission to and from the telephone line or private microwave circuits. The TDM-210 operates half or full duplex over 2 or 4-wire lines, respectively. Because of its asynchronous mode of operation no elaborate end-to-end synchronization is required, and transmission can begin and cease at will. The TDM-210 transmits and/or receives information at up to 1800 bits per second over a standard 3 kc voice type circuit. End-to-end communication is with another TDM-210 or Bell 202-D or its equivalent.

The TDM-210 is completely modular and of solid-state design to facilitate easy alignment and test, and provide maximum state-of-the-art reliability. Silicon transistors are used throughout. Because of its light weight, small size, low power requirements and only two cable connections—installation requirements are absolutely minimal. Power consumption is only 5 watts total. The TDM-210 is available in a smartly designed cabinet for desk top mounting or for rack mounting along with related equipment.

Because the TDM-210 Data Set matches EIA specification RS-232B it can transmit business machine or peripheral device information, meeting these same EIA specifications at up to the 1800 bits per second as mentioned above.

To minimize operator induced errors, only one control is located on the TDM-210. This control is a two position switch located on the rear panel (Figure 2) ;



FIG. 1

Position One is the normal or operate position and Position Two the test or "loop back" position. Mounted on the front panel, is an indicator which lights while DC is present internally, and, the test switch is in the operate position. If either of these two conditions is changed the control lamp extinguishes.

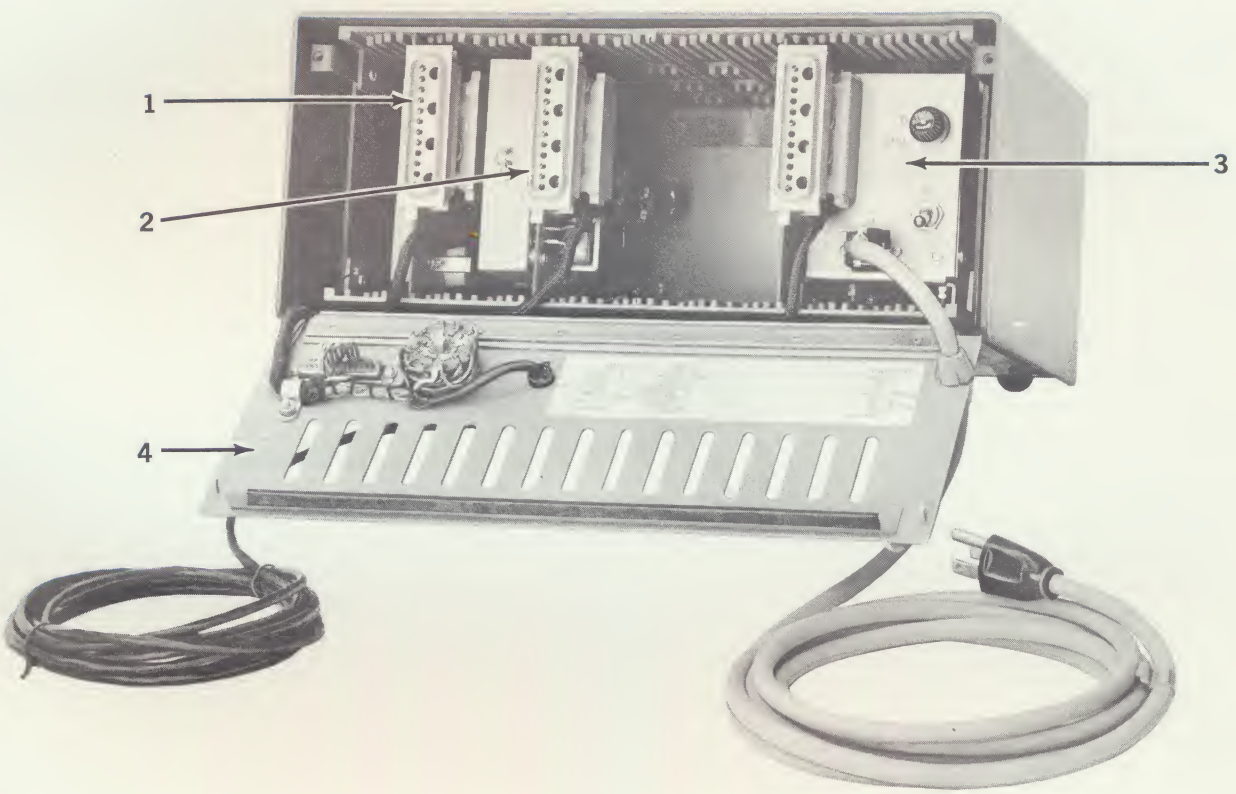
The TDM-210 is designed to condition and exchange data between the data equipment and telephone line at a maximum rate of 1800 bits per second. This maximum rate of transfer is accomplished over a voice circuit whose specifications are equivalent to those defined under FCC Tariff 260 for Schedule 4, Type 4B. The Data Set is also designed to match the lower line rate capabilities of Schedule 4, Type 4 and 4A lines. The data exchange rate for these latter type circuits are 1000 and 1400 bits per second, respectively.

The appropriate information signals enter the TDM-210 from the data terminal or telephone line-bit serially. Following signal conditioning, FM signals are presented to the telephone line or digital signals to the data terminal. Since each bit is handled serially, the particular machine code or number of levels of the code are of no particular significance.



1. Telephone Cord Connector
2. Standard RS-232 Cinch Socket (For Connecting to Data Terminal)
3. Test/Operate Switch (Shown in Operate Position)
4. Cooling Vents
5. Power Cord with Grounding Pin

FIG. 2—REAR VIEW



1. Transmitter Module
2. Receiver Module
3. Power Supply Module
4. Hinged Panel

FIG. 3—REAR VIEW (Hinged Panel Open)

All system alignment controls and circuit test points are located on the end of the printed circuit modules and are available immediately behind the hinged panel (Figure 3). It is, therefore, unnecessary to remove or place the modules on extenders for system alignment and test. A label on the inside of the hinged panel identifies each module's position in the cabinet and all test points on each module. Access to the modules for test and alignment is achieved by lowering the rear hinged panel.

The circuit test points and the modules they are associated with are listed below:

Transmitter	Receiver	Power Supply
+12 VDC	+12 VDC	+12 VDC
−12 VDC	−12 VDC	−12 VDC
+6.5 VDC	Carrier Input	Common Signal Ground
Transmitted Data	Carrier-Input to Preamp	
Request to Send	Data-Low Pass Filter Out	
Receiver Squelch	Received Data	
Clear to Send	Carrier Detector	
Carrier-Input to Filter	Signal Ground	
Carrier Output		
Signal Ground		

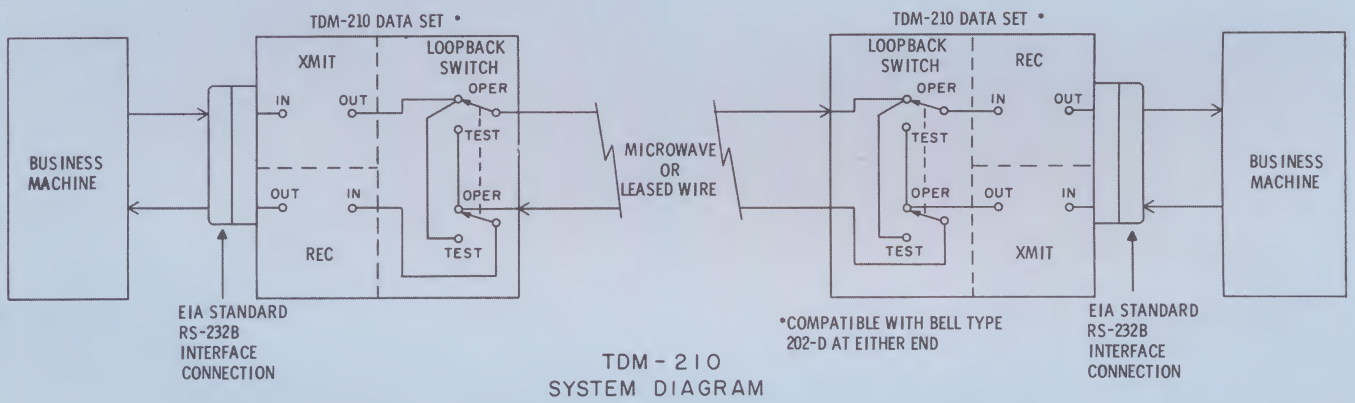
TEST/OPERATE SWITCH

The test/operate switch, located on the hinged panel, provides a means for analyzing 4-wire circuit operation. The switch connection in the circuit is diagrammed in Figure 4.

With the switch in the operate position, the transmit and receive modules of the Data Set are coupled to the telephone line for normal operation. With the switch in the test position, the output of the transmit module is coupled to the input of the receive module and the telephone line is looped. The test position provides a means for locating fault conditions encountered during transmission.

With the distant Data Set test switch in the test position, data can be transmitted from the local data terminal onto the line and looped back. This provides a means of testing the local and line transmission paths without the distant equipment in the circuit.

For 2-wire circuits, half-duplex operation only is allowed; therefore, the above test is not performed.

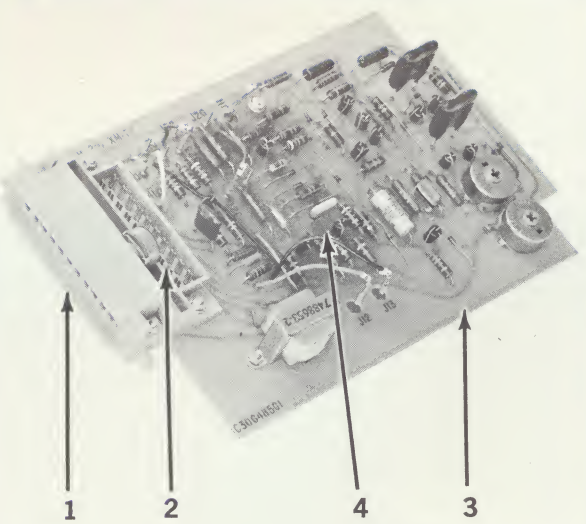


TDM-210
SYSTEM DIAGRAM

FIG. 4

TRANSMITTER OPERATION

Figure 5A pictures the transmitter module board and Figure 5B is a block schematic of the transmitter for the following operational description. The transmitter consists of a voltage controlled multivibrator which converts the binary input data into a frequency modulated signal suitable for transmission over the voice circuit. The transmitter responds to two input signals from the data terminal equipment: "Request To Send" and "Transmitted Data". The Request To Send signal turns the carrier "on" and "off" and the Transmitted Data signal shifts the multivibrator between the MARK/SPACE (NO BIT/BIT) frequencies. An Off signal on the Request To Send input turns carrier off and gives an Off signal on the Clear-To-Send lead. An On signal on the Request To Send input turns carrier on and causes the Clear-To-Send circuit to give an On signal after a fixed delay. Delays of 10, 60, 120 and 200 milliseconds may be customer selected by jumper option. An Off signal on the Request To Send lead also produces a 150 millisecond pulse at the transmitter receiver squelch output. This option is used in 2-wire operation to clamp the receiver in a marking condition for 150 milliseconds. This option



1. Signal Test Points
2. Module Connector Block
3. Epoxy Printed Circuit Board
4. Option Jumper Wiring

FIG. 5A—TRANSMITTER MODULE

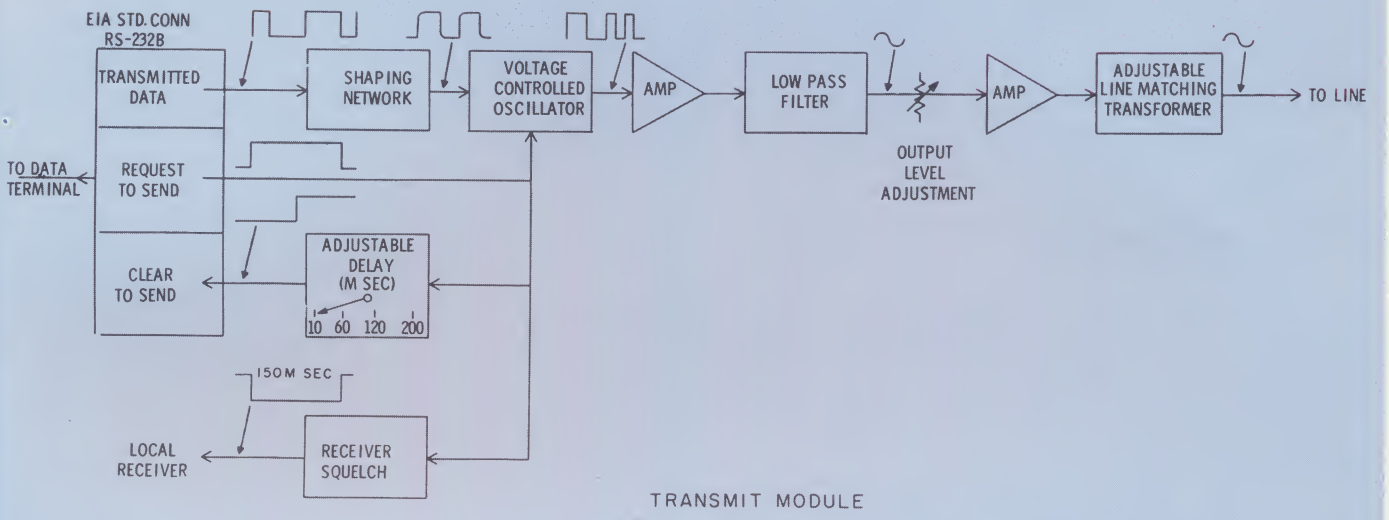


FIG. 5B

may be strapped out in 4-wire operation.

The MARK (No Bit) and SPACE (Bit) frequencies generated by the voltage controlled multivibrator are 1200 ±12 cps and 2200 ±22 cps respectively. Carrier is cut off only at the end of a carrier pulse. This prevents transients which might give false received data output in the received signal. Transmitted data is passed through a shaping network which reduces mark-to-space and space-to-mark rise times. This reduces unwanted frequency components in the carrier band.

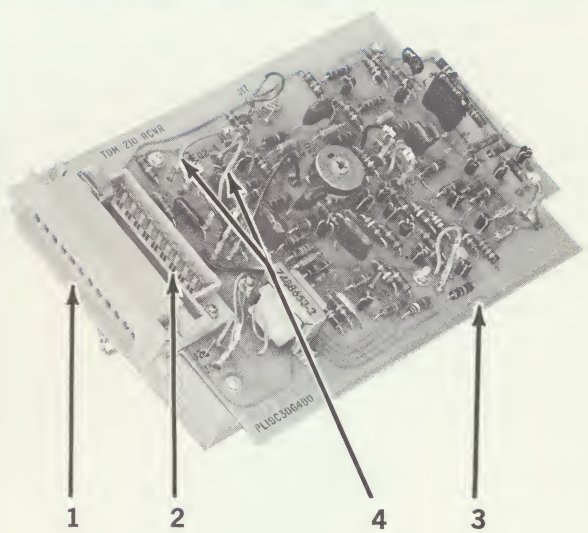
The output from the multivibrator is amplified and passed through a low-pass filter, resulting in a nearly sinusoidal carrier signal. Output of the low-pass filter is amplified and coupled to the line by a transformer. Output impedance of the transmitter is selected by jumper option and may be 600 ohms ±10%, and 900 ohms ±10% or greater than 6,000 ohms (for 2-wire operation). Carrier output level can be adjusted from −30 dbm to +6 dbm. This adjustment is located on the end of the transmitter module and adjustment can be made with the module in its normal operating position in the cabinet.

The maximum power requirement of the transmitter is 65 milliamps @ +12 VDC and 15 milliamps @ −12 VDC.

RECEIVER OPERATION

Figure 6A pictures the receiver module board and Figure 6B is a block schematic of the receiver for the following operational description. The receiver is coupled to the voice circuit by a transformer. The received signal is passed through a bandpass filter and through a compromise delay equalizer if needed. The input impedance of the receiver is 600 ohms ±10% or 900 ohms ±10% and is customer selected by jumper option. The delay equalizer may be strapped in or out. After the carrier signal has passed through the filter and equalizer, it is amplified by the pre-amplifier. The gain of the pre-amplifier is adjusted by a sensitivity control located at the input of the pre-amplifier. Amplitude equalization is also obtained in the pre-amplifier if required. This option may be strapped in or out. The slope of the amplitude equalizer is approximately 5 db per octave. The pre-amplifier provides an input signal for the limiter amplifier and level detector circuits.

In the limiter amplifier circuit the signal is squared, rectified and differentiated. This provides a sequence of negative pulses which mark the zero crossings of



1. Signal Test Points
2. Module Connector Block
3. Epoxy Printed Circuit Board
4. Option Jumper Wiring

FIG. 6A—RECEIVER MODULE

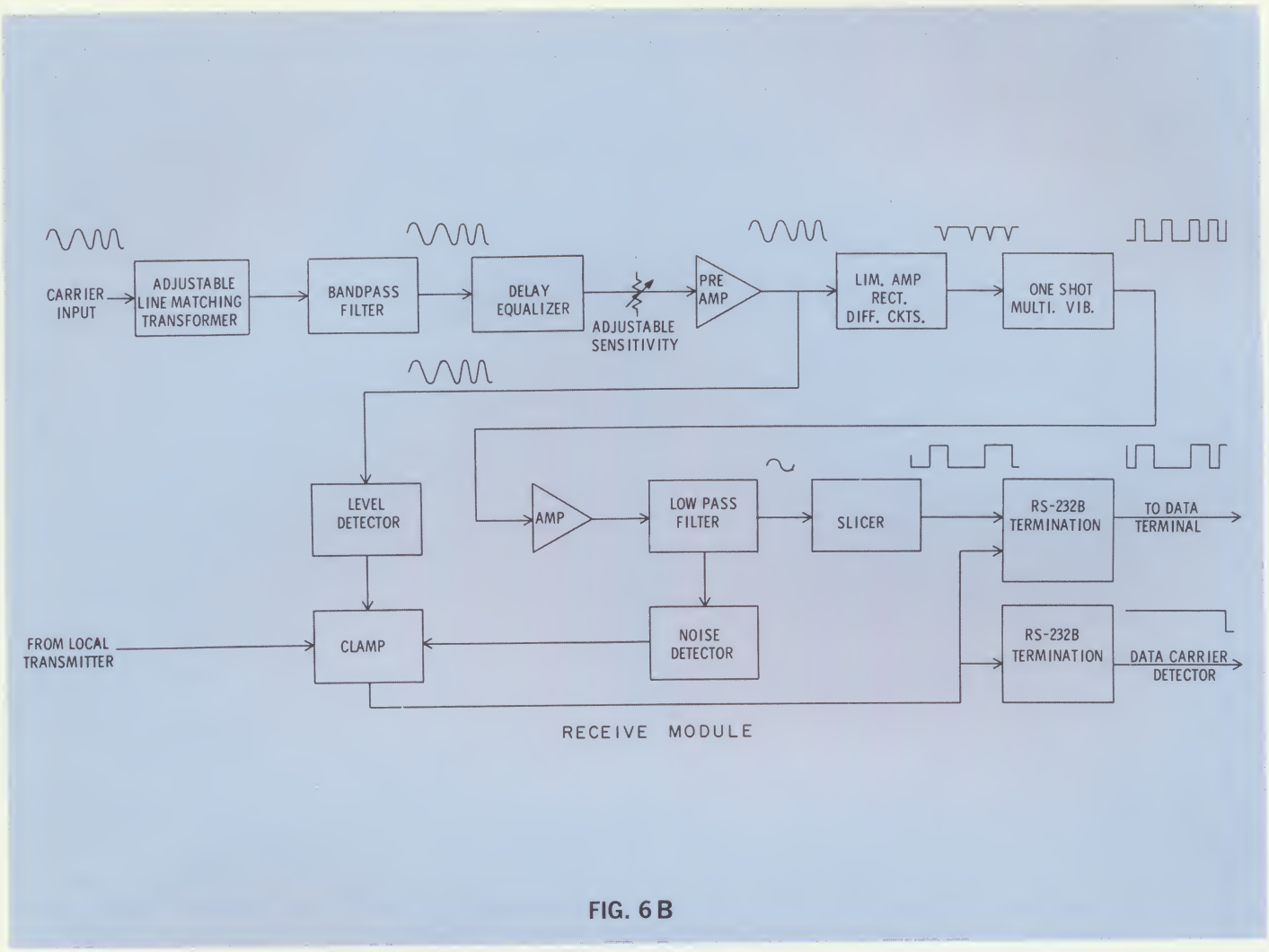


FIG. 6 B

the received signal. These pulses are used to trigger a one-shot multivibrator which gives an accurately timed pulse for each trigger pulse.

Pulses from the multivibrator are amplified and applied to the input of a low-pass filter. The low-pass filter integrates the pulses from the multivibrator, producing a more positive voltage for the higher frequency signal. This analog data wave from the output of the filter switches a differential amplifier. This amplifier has threshold level control to adjust for zero bias distortion. The resulting data signals are then converted to RS-232B data interface voltage signals by the output amplifier.

The level detector circuit clamps the output amplifier in a marking condition until the input signal reaches sufficient level for limiting. A noise detector circuit connected to the output of the low-pass filter also clamps the output amplifier in a marking condition when there is no signal input. When a signal is applied to the receiver the clamp is removed after 40 milliseconds. The clamp has a hold-over time of 15 milliseconds so that short dropouts of carrier will not clamp the receiver in a MARK condition. The clamp circuit may be strapped out when necessary. The level and noise detector output signals are converted to RS-232B data interface voltage signals by the carrier detector output amplifier.

Limiting circuitry is set to allow for a signal fade margin of 10 db. The sensitivity control is located at the end of the receiver module and the adjustment is made with the module in its normal operating position.

The maximum power requirement of the receiver is 30 milliamps @ +12 VDC and 10 milliamps @ −12 VDC.

RACK MOUNTING

Where a need exists for multiple Data Sets at a single location, provision is made for rack mounting. When rack mounted, up to 5 Data Sets can be accommodated by a single power supply. Under this arrangement the 5 Data Sets and power supply would occupy two standard 19″ rack shelves, 7 and 5¼ inches respectively, or a total of 7 rack units high. Three Data Sets would occupy one shelf and the two remaining Data Sets and the power supply would occupy the second shelf. Multiple shelf arrangements are available by stacking.

CONNECTION TO VOICE CIRCUIT

Transformer coupling to the telephone line provides metallic isolation between the Data Set and the actual telephone line itself. A 12 ft., four conductor, telephone type cord is supplied for connecting the Data Set to the telephone line facility.

COOLING

Because of low heat generation, natural air flow is sufficient to prevent heat buildup within the TDM-210 Data Set. Cooling air enters the unit along the bottom sides, flows over the modules and exits through air vents in the hinged panel in the rear.

RELIABILITY

Highest quality component parts are used throughout the TDM-210, and are of standard make and available from multiple sources.

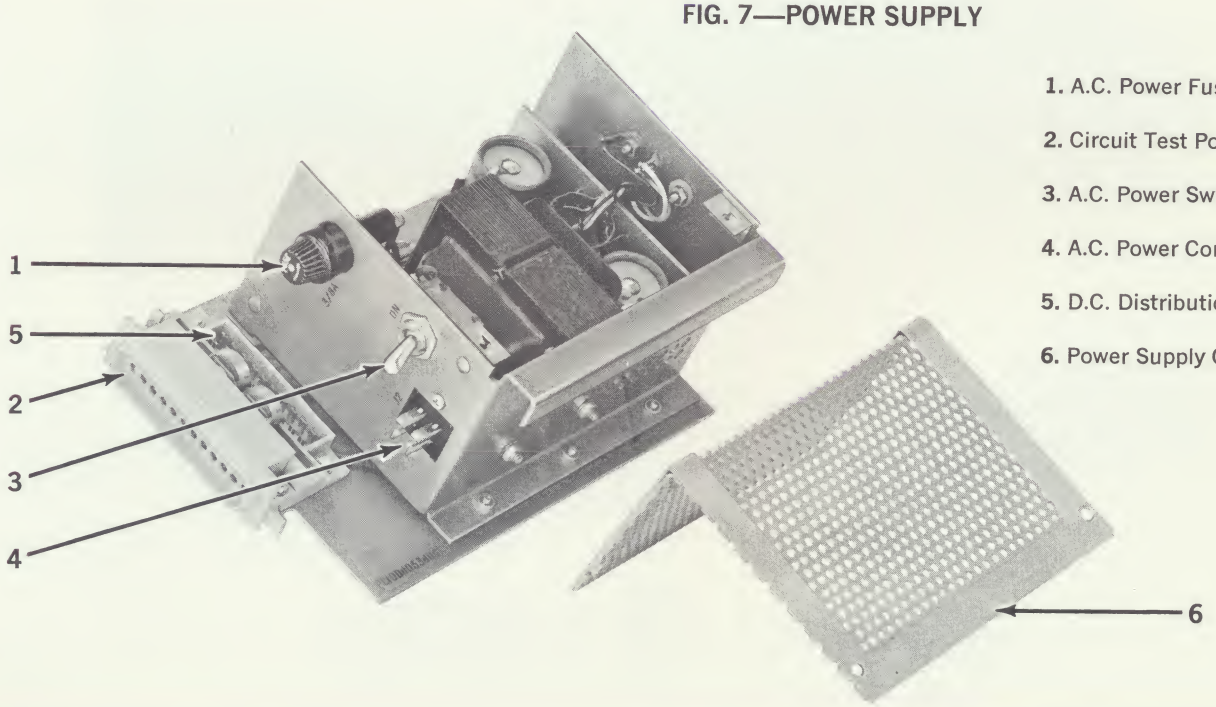
MTBF (Mean Time Between Failure) reliability figures, in thousands of hours, have been established for each module as well as the complete Data Set. These figures were established with the RADC Reliability Notebook as reference and are available upon request.

POWER SUPPLY

The power supply module is shown in Figure 7. The DC output is "short proof". If the load on the supply becomes shorted the supply is deactivated and the indicator lamp extinguishes, noting this condition. The power supply module plugs into either the desk or rack mounted cabinet. A 10-foot power cord with ground conductor and pin is supplied.

Shielding and protection from accidental contact with 115 AC is provided by a dust cover over the power supply. AC power is fused at ⅜ amps using standard AGC type fuses. To prevent accidental turn-off of AC power, the AC power switch is located on the power supply module inside the Data Set.

FIG. 7—POWER SUPPLY



1. A.C. Power Fuse
2. Circuit Test Points
3. A.C. Power Switch
4. A.C. Power Connector
5. D.C. Distribution Connector
6. Power Supply Cover

TECHNICAL SUMMARY

COMPATIBILITY
On line with Bell 202D

MODULATION TECHNIQUE—Frequency Shift Keyed (FSK)

FREQUENCIES—Mark—1200 cps
Space—2200 cps

DATA RATES, FCC TARIFF 260—
1000 Bits/Sec. Schedule 4
1400 Bits/Sec. Schedule 4A
1800 Bits/Sec. Schedule 4B

LOOPBACK SWITCH—Connects transmitter output to receiver input; connects receive line to send line.

PILOT LAMP—Indicates that D.C. power is present and that loopback switch is in the "operate" position.

A.C. REQUIREMENTS—
117 v ±10% 50-60 cps

POWER CONSUMPTION—5 watts.

OPERATING ENVIRONMENT—
Temperature −20°C to +60°C
Relative Humidity 0 to 95%
Altitude 0 to 10,000 ft.

SIZE—9″ x 13¾″ x 6″ High

WEIGHT—14.5 Pounds

MOUNTING—Rubber Feet

CONNECTIONS—
Line; 4 Wire Telephone cord, 12 ft.
Digital; 25 pin Cannon or Cinch DB25S connector
Power; 3 Wire Cord included, 10 ft.

LINE 2 wire or 4 wire
Xmit level —+6 dbm to −30 dbm
Rec level —−30 dbm threshold
Impedance—600 or 900 ohms

DIGITAL INTERFACE—
Complies with EIA-RS232B

DIGITAL SIGNALS PROVIDED—

AA	1	Protective Ground
AB	7	Signal Ground
BA	2	Transmitted Data
CA	4	Request to Send
CB	5	Clear to Send
BB	3	Received Data
CF	8	Data Carrier Detector
CC	6	Data Set Ready
	9	+12 VDC (test purpose only)
	10	−12 VDC (test purpose only)

CARRIER DETECTOR—
Operate Time 40 Msec.
Release Time 15 Msec.

JUMPER SELECTABLE FUNCTIONS

CLEAR TO SEND—Delay, 10, 60, 120, 200 Msec.

CLAMP—Holds "received data" in mark condition when carrier is absent.

SQUELCH—Holds "received data" circuit in mark condition for 150 ms after "request to send" is dropped.

PHASE EQUALIZER—(Referred to 1900 cps)
900 μs at 600, 3000 cps
250 μs at 1200, 2300 cps

SLOPE EQUALIZER—5 db/octave

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